付編 6　工業標準化・品質管理に関する企業アンケート調査要約

CONTENTS

1. BACKGROUND

1.1 OBJECTIVES OF THE SURVEY

The primary objective of the survey was to identify the needs of manufacturing establishments on the promotion of industrial standardisation and quality control.

1.2 SCOPE OF THE STUDY

The questionnaire designed for the survey covered such areas as:-

- Business unit profile eg. location of business, year of establishment, number of employees, shareholders fund, annual sales, major industrial groups etc.

- Industrial standards eg. types of industrial standards used, technological level etc.

- Certification eg. MS Mark certification system, reasons not applied for Mark of Quality, ARQS, reasons for not applying for ARQS etc.

- Quality control eg. activities adopted for quality control, problems encountered in implementation etc.

- Testing facilities eg. usage of outside facilities, satisfaction of using outside facilities, expectations of setting up outside laboratories etc.

- Manpower and R & D eg. types of qualified staff, activities engaged in, likelihood of commissioning future R & D assistance from outside.

1.3 METHODOLOGY

The survey was conducted as a mail survey. Approximately 1,500 establishments were selected within certain specified industries to whom blank questionnaires were mailed. Questionnaires were multi-lingual in that they were translated into English, Bahasa Malaysia and Chinese.

1.4 FIELDWORK PERIOD

Two mailouts were conducted, the first in late May 1992 and the second in early July. The survey was closed on 21st September. Wherever possible telephone calls were made to remind respondents to send in the completed questionnaires.

1.5 INDUSTRIES SELECTED FOR THE SURVEY

The following industries were selected to be covered for the survey:-

Industry	Sub-Industry
- Textile and apparel	- Fiber and yarn - Woven and knitted fabrics - Tricot and lace fabrics, woven and non-woven, interlining and printing, dying and finishing - Garments - Accessories
- Plastic processing	-
- Rubber related products and processing	-
- Automotive	- Automotive assembles - Automotive parts manufactures
- Electrical and electronics	-
- Metal and engineering	- Foundry - Mould and die - Steel fabrication, metal and welding, machine shop, and machinery and parts manufacturing.
- Construction materials	- Cement and concrete products - Brick, ceramic and gypsum products - Wood and wood products - Steel bars

1.6 SOURCES OF NAMES OF MANUFACTURING ESTABLISHMENTS

The following sources were referred to in selecting the names of establishments to whom questionnaires were sent:-

Industry	Source
- Textile and apparel	- Malaysian Textile Manufacturers Association Directory (1992)
- Plastic processing	- Malaysian Plastic Manufacturers Association Directory (1992)
- Rubber related products	- Rubber Products Manufacturers Association
- Automotive	- Automotive Assemblers in Malaysia (MIDA) - List of Companies Producing Automotive Components in Malaysia (MIDA)
- Electrical and electronics	- Directory of Existing Electrical Product Manufacturers (MIDA)
- Metal and engineering	- Directory of Federation of Malaysian Founding and Engineering Industries Association (1992)
- Construction materials	- Federation of Malaysian Manufacturers' Directory - Cement Association of Malaysia - Malaysian Panel-products Manufacturer's Association.

1.7 NUMBER OF QUESTIONNAIRES MAILED OUT

Table 1 shows the distribution of the selected industries by state and the number of questionnaires mailed out to each industry.

TABLE 1 : NUMBER OF ESTABLISHMENTS SELECTED BY STATE

	Johore	Penang	Melaka	Perlis	KL/ Selangor	Perak	Sabah	Kedah	Panang Trengganu Kelantan	Negeri Sembilan	Total Questionnaires Mailed out
Textile and apparel	68	32	12	2	25	14	1	7	3	1	165
Plastics Processing	67	46	-	-	91	51	-	10	-	-	265
Rubber products	18	24	7	1	82	28	2	5	4	4	175
Automotive	15	12	-	-	130	8	-	4	-	-	169
Electrical and electronics	22	20	-	-	70	5	-	1	-	-	118
Metal and engineering	123	64	-	-	169	61	-	44	-	-	461
Construction materials	13	10	6	5	64	27	7	7	8	10	157
Total	326	208	25	8	631	194	10	78	15	15	1510

2. BUSINESS UNIT PROFILE

2.1 LOCATION OF FACTORY

Some of the manufacturing establishments covered for the survey had more than one factory, thereby, accounting for 308 factories. (Table 2)

TABLE 2 : LOCATION OF FACTORIES

State	Number	%
Selangor	127	41
Kuala Lumpur	43	14
Penang	34	11
Perak	53	17
Johore	35	11
Kedah	6	2
Negeri Sembilan	5	2
Malacca	5	2
TOTAL	**308**	**100**

Most of the establishments covered for the survey had their factories located within the Klang Valley region (comprising Kuala Lumpur and a large part of Selangor). Together they accounted for more than half (55%) of factories belonging to establishments survey.

The West Coast of Peninsular Malaysia being the main economic lists of Malaysia is further emphasised by the presence of factories in Perak (17%) Penang (11%) and Johore (12%).

2.2 YEAR OF ESTABLISHMENT

A large number of establishments were relatively new entrants into the industry (Table 3). Approximately 23% were established between 1986 and 1990, while 14% were established between 1981 and 1985. The decade from 1981 to 1990 alone, therefore, saw the establishment of 113 of the 303 manufacturers surveyed (37%).

Another 99 establishments commenced operations in the decade 1971 to 1980, representing 33% of those surveyed.

Therefore the two decades, from 1971 to 1990 saw the establishment of 212 manufacturers (70%), mainly as a result of the Governments emphasis towards industrialisation.

TABLE 3 : YEAR OF ESTABLISHMENT

Year	Number	%
1960 and before	27	9
1961 to 1965	14	5
1966 to 1970	23	8
1971 to 1975	49	16
1976 to 1980	50	17
1981 to 1985	42	14
1986 to 1990	71	23
1991 and later	10	3
Refuse	17	6
Total	**303**	**100**

2.3 NUMBER OF EMPLOYEES

A large number of the manufacturers surveyed had a fairly large work force. Approximately 44% were in the category of having 101 and more employees as at 31st December 1991. [Table 4]

A significant number also had various levels of employment below 50 workers. Approximately 36% (108 establishments) belonged to this category.

TABLE 4 : NUMBER OF EMPLOYEES

Employees	Number	%
10 and below	30	10
11 to 25	34	11
26 to 50	44	15
51 to 75	23	8
76 to 100	32	11
101 and above	133	44
Refused	7	2
Total	**303**	**100**

2.4 SHAREHOLDERS FUND

A significant number of firms were small-scale manufacturers having a shareholders fund of below M$500,000. As seen from Table 5, 87 such establishments (29%) fell into this category, while another 76 establishments (25%) had a shareholders fund of between M$500,000 to M$2.5 million.

Distribution of manufacturers indicates 53 manufacturer (18%) that were in the large scale sector, having a shareholders fund of above M$10 million.

TABLE 5 : SHAREHOLDERS FUND

Shareholders Fund	Number	%
Below M$500,000	87	29
M$500,000 to M$2.5 million	76	25
M$2.5 million to M$5 million	28	9
M$5 million to M$10 million	33	11
M$10 million to M$50 million	39	13
M$51 million and above	14	5
Refuse	26	9
Total	**303**	**100**

2.5 ANNUAL SALES

Table 6 gives the approximate sales in 1991 of the 303 establishments. As can be seen, being mostly small-scale establishments, about one-third (33%) had sales of below M$3 million in 1991, while about one-fifth (20%) had sales of between M$3 million and M$8 million.

The number of establishments slowly tapered off as the distribution of annual sales increased, although there were 8% of establishments that grossed more that M$101 million being the large-scale manufacturers.

TABLE 6 : ANNUAL SALES IN 1991

Sales	Number	%
Less than M$3 million	99	33
M$3 million to M$8 million	62	20
M$8 million to M$25 million	46	15
M$25 million to M$50 million	31	10
M$50 million to M$100 million	11	4
M$101 and above	24	8
Refused	30	10
Total	**303**	**100**

2.6 MAJOR INDUSTRIAL GROUP

Many of the 303 manufacturers responding to the survey displayed some diversity in their operations. As shown in Table 7, a total of 373 responses were recorded in relation to their activities.

Most of these activities were in the Metal and Engineering industry, where 115 responses (32%) were recorded. Establishments in this sector were engaged in more than one activity.

Similarly in the Automotive industry 11% of the responses were recorded (3% for Automotive assembly and 8% for Automotive parts manufacturing). In the Textile industry, establishments were engaged in Fiber and yarn, Woven and knitted fabrics, and Tricot and lace activities accounting for a total of 4%.

Among the `specialist' industries, Plastic processing was the most prominent with 81 establishments engaged in this activity (22%), followed by Rubber related products and processing (9%) and Electrical and Electronics (8%).

TABLE 7 : MAJOR INDUSTRIAL GROUP

Industrial Group	Number	%
Fiber and yarn	9	2
Woven and knitted fabrics	8	2
Tricot and lace	2	–
Garments	20	5
Plastic processing	81	22
Rubber related products and processing	34	9
Automotive assembling	10	3
Automotive parts manufacturing	29	8
Electric and electronics	28	8
Foundry	25	8
Mould and die	18	5
Steel fabrication	20	5
Metal and welding, machine shop	52	14
Cement and concrete products	16	4
Brick, ceramic and gypsum products	12	3
Wood and wood products	7	2
Steel bars	2	–
Total	**373**	**100**

2.7 MAJOR PRODUCTS MANUFACTURED

A wide variety of products were manufactured by the establishments. The more prominent products were from the plastics industry where 20% of responses were recorded (Table 8). The metal and engineering industry, producing metal products and machinery parts together accounted for 14%.

Another `specialist' industry, electrical and electronics represented 10% of the 351 respondents recorded. Other noticeable products manufactured were rubber products (9%) car accessories (8%) and garments and fabrics (8%).

TABLE 8 : MAJOR PRODUCTS MANUFACTURED

Major Products	Number	%
Pipes	13	4
Cement	6	2
Car accessories	30	8
Plastic products	71	20
Rubber products	33	9
Electrical and electronic items	35	10
Metal products	41	12
Motorcycle accessories and parts	3	1
Household items	16	5
Lighting	3	1
Wood products	6	2
Construction material	21	6
Garments and fabrics	27	8
Chemicals	2	1
Machinery parts	9	2
Others	22	6
Refused	13	4
Total	**351**	**100**

2.8 MAJOR MARKETS

Most of the 303 manufacturing concerns saw themselves as a source of exports for overseas market. Except for 33% of establishments which did not export any of their products to overseas market, most of the others had varying levels of export sales. On the one extreme 17% indicated that export sales accounted from between 1% to 10%, while 16% indicated exporting from between 91% to 100% (Table 9). Between these two ends of the scale other establishments had various levels of exports.

As domestic sales, the trend was generally towards final sales, rather than their products sold as an intermediate good for the domestic market or export market.

TABLE 9 : MAJOR MARKETS
(AS PERCENT OF ANNUAL SALES)

Percent of Export Market	Export Sales %	As final products %	As manu-facturing materials for domestic %	As manu-facturing sales for export %
1 to 10 percent	17	6	7	6
11 to 20 percent	7	4	2	3
21 to 30 percent	5	2	2	1
31 to 40 percent	5	4	1	2
41 to 50 percent	3	2	3	1
51 to 60 percent	2	3	1	–
61 to 70 percent	3	4	2	–
71 to 80 percent	3	7	1	–
81 to 90 percent	2	6	3	–
91 to 100 percent	16	30	6	2
None	33	30	70	82
Refuse	3	3	3	3
Total	**100**	**100**	**100**	**100**

2.9 MAJOR SOURCES OF RAW MATERIALS

On the procurement of raw materials, 36% of the firms indicated that they did not import them directly from abroad (Table 10). Apart from 8% of the firms that refused, the remaining indicated getting raw materials from abroad, but to varying degrees. Approximately 12% procured between 1% to 10% of raw materials directly from sources abroad.

Most of the establishments had a tendency to procure raw materials from domestic sources. Apart from 11% who did not get them locally and 8% who refused, the rest obtained their supplies from domestic sources.

The fact that very few firms indicated getting their overseas supply via domestic sources, seems to indicate that of those who obtain raw materials from abroad, did so directly.

TABLE 10 : MAJOR SOURCES OF RAW MATERIALS
(AS PERCENT PURCHASE OF RAW MATERIALS)

Percentage Purchase	Direct imports %	Domestic sources %	Imported Materials via domestic sources %
1 to 10 percent	12	8	11
11 to 20 percent	7	10	7
21 to 30 percent	6	5	7
31 to 40 percent	4	5	2
41 to 50 percent	6	8	4
51 to 60 percent	3	5	3
61 to 70 percent	4	7	2
71 to 80 percent	6	6	2
81 to 90 percent	4	7	1
91 to 100 percent	5	20	6
None	36	11	47
Refuse	8	8	8
Total	**100**	**100**	**100**

2.10 CAPITAL INVESTMENT TIE-UPS

A majority of the establishment did not have capital investment linkages with foreign firms (Table 11).

Among those that did have foreign partners, Japan was the more prominent, while Singapore and Europe were also quite significant.

By industries, Fiber and yarn and Woven and knitted fabrics had substantial Singapore interests, as well as Japanese.

Japanese interests were also quite significant in the Automotive assembly industry (20%), Electrical and Electronics (14%), Foundry (16%) and Wood products (Table 14).

TABLE 11 : CAPITAL INVESTMENT TIE-UPS

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Stee bar
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	12	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Singapore	5	22	38	15	11	6	-	-	-	8	6	-	2	-	-	14	-
Other ASEAN	1	-	-	-	-	3	-	3	7	-	-	-	-	-	-	-	-
Taiwan	2	-	-	15	2	3	-	10	-	4	6	-	-	-	-	-	-
Hong Kong	3	11	25	25	1	-	-	4	-	-	-	-	-	-	-	-	-
Republic of Korea	1	-	-	-	-	3	-	-	-	-	-	-	-	6	-	-	-
Japan	9	22	13	-	7	-	20	10	14	16	11	-	8	-	8	14	-
USA	2	-	-	-	1	9	10	-	7	-	-	5	-	-	-	-	-
Europe	5	-	-	5	1	9	-	7	18	-	-	-	-	13	-	14	-
Australia	1	-	-	-	2	3	-	-	-	-	-	-	-	-	-	-	-
Others	2	11	13	-	1	-	-	3	4	-	6	-	2	-	8	-	-
None	73	56	38	40	75	71	70	72	54	80	78	95	88	81	83	57	100

2.11 TECHNICAL TIE-UPS

Like the financial tie-ups most of the firms indicated that they did not have technical affiliations with foreign firms (Table 12). Among those that did, the countries were most noticeably Japan (11%) followed by Europe (8%).

Common industries affiliated with Japan were Automotive assembly, Fiber and yarn, Cement and concrete products and automotive parts manufacturing.

TABLE 12 : TECHNICAL TIE-UPS

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	12	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Singapore	2	11	13	-	5	3	-	-	4	-	-	-	-	6	-	14	-
Other ASEAN	1	-	-	-	-	3	-	3	4	-	-	-	-	6	-	-	-
Taiwan	2	-	-	-	1	3	-	7	4	4	-	5	-	6	-	-	-
Hong Kong	1	11	13	5	-	-	-	-	4	-	-	-	-	-	-	-	-
Republic of Korea	1	-	-	-	1	3	-	-	-	4	6	-	-	-	-	-	-
Japan	11	22	13	-	7	15	60	31	7	4	11	-	4	19	8	14	-
USA	3	-	-	-	1	9	-	-	4	8	6	-	2	6	8	-	-
Europe	8	-	-	5	2	12	30	14	25	4	11	5	4	25	-	-	-
Australia	1	-	-	-	2	6	-	-	-	-	-	-	-	-	-	-	-
Others	2	-	-	-	1	-	-	7	7	-	6	-	2	-	8	-	-
None	75	56	63	90	79	59	40	45	61	88	78	90	88	69	83	71	100

3. INDUSTRY STANDARDS

3.1 RAW MATERIALS/INTERMEDIATES/COMPONENT PARTS/AUXILLARY MATERIALS PROCURED

Of the 303 firms surveyed, a surprisingly small number only were using MS Standard for raw materials purchased (Table 13). This was true for Product Standard (9%), Method Standard (8%) and Basic Standard (6%).

Most of these firms claimed using either their own company standard or international standard. Approximately 29% of firms claimed using their company standard and 23%, international standards for their product.

In terms of standards necessary, these establishments were quite equal in their opinions or foreign standards and company standards. Approximately 16% on firms indicated that foreign and company standard were necessary for their products. An almost equal number further felt that these same standards were necessary for methods as well term/vocabulary/nomenclature.

TABLE 13 : INDUSTRIAL STANDARDS FOR RAW MATERIALS/INTERMEDIATES/COMPONENT PARTS/AUXILLARY MATERIALS BOUGHT

	--Standards Used---			------Standard Necessary---------			
	MS	Company Std.	Intern. Std.	Foreign Std.	As A New MS	As A Revised MS	As Company Std.
Base:	303	303	303	303	303	303	303
	%	%	%	%	%	%	%
Product Standard	9	29	23	16	4	2	16
Method Standard	8	25	17	13	6	3	13
Basic Standard	6	23	17	13	4	2	11

3.2 MACHINERY/EQUIPMENT/SPARE PARTS PROCURED

A similar scenario is noticed for establishments procuring machinery, equipment or spare parts. Only a small proportion of the 303 firms surveyed were using the MS Standard (Table 14) –4% for their products, 5% for method and 4% for basics.

However, approximately one in four firms (25%) were using their company standards for their products and 22% using international standards. A somewhat similar trend is seen for methods and basics.

In terms of standards necessary a trend similar to the firms that purchased raw materials is seen. The general concensus is that foreign standards and company standards were generally necessary.

TABLE 14 : INDUSTRIAL STANDARDS FOR MACHINERY/EQUIPMENT/ SPARE PARTS BOUGHT

	--Standards Used---			-------Standard Necessary---------			
	MS	Company Std.	Intern. Std.	Foreign Std.	As A New MS	As A Revised MS	As Company Std.
Base:	303	303	303	303	303	303	303
	%	%	%	%	%	%	%
Product Standard	4	25	22	15	4	2	15
Method Standard	5	20	17	11	4	3	12
Basic Standard	4	18	18	12	3	3	11

3.3 TECHNOLOGICAL LEVEL AIMED AT IN COMPANY STANDARD

Almost half of the companies survey (47%) indicated that they were striving for international technology standards, while another 26% indicated aiming for foreign standards. About a quarter of them (25%) either were not aiming for any sort of technology levels or did not answer (Table 15).

Of the 47% firms that were aiming for some international technological level, the most significant were from Fiber and Yarn (78%), Rubber processing and products (74%), Electrical and Electronics (71%) and *Cement and Concrete products* (69%) industries.

Among those that indicated aiming for some foreign standard industries that were prominent were Automotive assembling (48%), Foundry (52%), Cement and concerte products (44%) and steel bars (50%).

TABLE 15: TECHNOLOGICAL LEVEL AIMED AT IN COMPANY STANDARDS

	Total	Fiber And Yarn	Woven	Gar-ments	Plas-tic	Rub-ber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould And Die	Steel Fabr.	Metal Weld.	Ce-ment	Brick	Wood	Steel Bars
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	17	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
MS	18	22	13	-	16	21	-	-	21	32	11	15	10	56	42	14	50
Intern. Std.	47	78	63	25	40	74	50	55	71	44	39	50	37	69	33	29	50
Foreign Stds.	26	11	13	30	14	21	30	48	18	52	28	20	35	44	8	29	50
Others	7	11	13	15	7	12	10	7	-	8	11	10	8	13	-	14	-
None	25	-	25	40	36	15	20	10	11	8	28	30	29	6	25	43	-

4. POSSESSION OF CERTIFICATION

4.1 MS MARK CERTIFICATION SYSTEM

A vast majority of firms interviewed did not have any products that were applicable to the Mark of Quality (Table 16). Approximately 182 of the surveyed establishment indicated this (60%) while 78 had products that qualified (26%). Approximately 14% could not give an appropriate answer.

No one industry had a majority in claiming a Mark of Quality as the absence of this was noticed in all the industry groups except Steel bars. But then again, the base was too small as only two firms in this industry responded.

However, among those that did have products that qualified (78 firms), 60% (Table 14) were licensees who could use the Mark of Quality. Industries in which the majority of the firms who were licensees were Rubber and rubber products (57%), electrical and electronics (92%), Foundry, Mould and die, Steel fabrication, Cement and concrete products and Bricks, ceramic and gypsum products.

TABLE 16 : PRODUCT APPLICABLE TO MARK OF QUALITY

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	12	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Yes	26	44	25	-	17	41	30	21	43	28	17	10	19	69	42	29	100
No	60	56	38	70	64	47	40	59	57	64	67	75	73	25	42	43	-
Don't know	14	-	38	30	19	12	30	21	-	8	17	15	8	6	17	29	-

TABLE 17 : LICENSEES OF MARK OF QUALITY

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	78	4	2	0	14	14	3	6	12	7	3	2	10	11	5	2	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Yes	60	-	-	-	43	57	33	33	92	57	67	100	40	82	80	50	-
No	40	100	100	-	57	43	67	67	8	43	33	-	60	18	20	50	100

4.2 REASONS FOR NOT APPLYING FOR MARK OF QUALITY

Table 18 gives the mean scores of eight reasons that were ranked from 1 to 8, with 1 being the most important and 8 being the least important.

As may be seen, the most important reasons for not applying for the Mark of Quality was that customers do not insist on it (means score of 2.0). This thus indicates that either manufacturers take the customers for granted, or that customers do not really see the benefits of insisting on quality. Awareness of customers is therefore lacking.

Costs involved in applying for the Mark of Quality is the second most important reasons (mean score of 2.4) thus giving rise to the need for making it less costly for small and medium scale industries to apply. This was particularly felt by firms in the Mould and die industry (1.0) and Rubber and related products and processing industries (1.7).

Other reasons cited by the manufacturers were:-

- Requirements are too complicated (3.0)
- Do not expect any good results (4.0)
- Applied before but found it not effective (5.5)
- Product quality does not conform with Mark of Quality (5.7)
- Applied once but could not maintain requirements (6.8)

TABLE 18 : REASONS FOR NOT APPLYING FOR MARK OF QUALITY (MEAN SCORE)

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Do not expect good results	4.0	4.5	4.5	-	5.3	7.5	-	2.3	-	5.0	6.0	-	3.0	5.0	-	7.0	-
Customer do not ask for it	2.0	1.3	1.0	-	2.0	2.8	-	2.3	-	1.0	5.0	-	1.0	2.0	-	1.0	-
Applied but found not effective	5.5	2.0	2.0	-	4.7	5.0	-	6.0	-	6.0	8.0	-	7.0	1.0	-	2.0	-
Preparation is costly	2.4	2.3	3.0	-	2.5	1.7	2.0	2.7	-	4.0	1.0	-	2.3	3.0	-	3.0	-
Requirements are *complicated*	3.0	3.0	4.0	-	3.0	4.0	1.0	3.5	-	3.0	3.0	-	2.0	4.0	-	4.0	-
Product quality does not conform with Mark of Quality	5.7	5.0	5.0	-	4.0	6.5	-	7.0	-	2.0	1.0	-	5.0	6.0	-	5.0	-
Applied once but could not maintain requirements	6.8	6.0	6.0	-	5.7	7.0	-	7.0	-	7.0	4.0	-	7.5	7.0	-	6.0	-

4.3 MATERIALS/INTERMEDIATES/COMPONENT PARTS/ AUXILLARY MATERIALS APPLICABLE TO MARK OF QUALITY

Among firms that did not have products applicable to the Mark of Quality, or were not licensees of the Mark of Quality were asked if they had raw materials or component parts that were applicable to the Mark of Quality. The results of this inquiry is given in Table 19.

Of the 260 firms, 26% indicated that their component parts were qualified to use the Mark of Quality, 64% did not and 10% were not sure. Significant industries among those that did not even have raw materials applicable to the Mark of Quality were Woven and knitted textiles, Garments, Automotive assembly, Automotive parts, Brick and Ceramics and Wood products.

4.4 REQUEST SUPPLIERS TO APPLY FOR MARK OF QUALITY

Of the 68 firms that claimed that their component materials were applicable to the Mark of Quality, the majority also required their suppliers to apply for the Mark of Quality as indicated by 56% of them (Table 20). Industries that were insistent on this requirement were Electrical and Electronics, Mould and Die, Steel fabrication and cement and concrete products.

Such firms, that had raw materials and component parts applicable to the Mark of Quality generally therefore expected a reciprocal requirement from their suppliers.

TABLE 19 : MATERIALS/INTERMEDIATES/COMPONENT PARTS /AUXILLARY MATERIALS APPLICABLE TO MARK OF QUALITY

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	260	9	5	14	66	30	7	23	28	23	15	17	48	15	.10	5	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Yes	26	33	-	-	32	33	29	22	29	35	27	41	25	33	20	-	100
No	64	56	80	79	59	53	71	70	68	61	53	41	65	60	80	80	-
Don't Know	10	11	20	21	9	13	-	9	4	4	20	18	10	7	-	20	-

TABLE 20 : REQUEST SUPPLIERS TO APPLY FOR MARK OF QUALITY

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	68	3	-	-	21	10	2	5	8	8	4	7	12	5	2	-	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Yes	56	33	-	-	57	50	100	40	75	50	75	71	58	60	100	-	100
No	44	67	-	-	43	50	-	60	25	50	25	29	42	40	-	-	-

4.5 ASSESSMENT AND REGISTRATION OF QUALITY SYSTEM (ARQS)

Only 38 of the 303 respondening manufacturers (13%) were registered firms for the ARQS, while 211 (70%) were not. Almost one-fifth of these firms (18%) were quite ignorant of the ARQS.

Those firms that were not registered with the ARQS were asked to rank their reasons for not applying. The mean scores are shown in Table 21.

The fact that "customers do not require us to be a registered firm" again was the most important reasons, a fact that was reaffirmed by all the industries (mean score of 1.5).

In descending order of importance, these eight reasons were:-

Customers do not require us to register	(1.5)
Requirements are too complicated	(2.8)
Preparation for registration is too costly	(3.1)
Application procedures are too complicated	(3.8)
Do not expect good result by the ARQS	(4.0)
Our product does not conform with the standard	(4.8)
Applied once but quit after finding it not effective	(6.3)
Applied once but could not maintain requirements	(6.7)

Other reasons were given by responding firms but responses were too small to detect any meaningful scores. These were:-

In the process of applying
Follow standards set by clients
Not ready yet
Not aware of standard
Do not have facilities yet

TABLE 21 : REASONS FOR NOT APPLYING FOR AROS (MEAN SCORE)

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Do not expect good results	4.0	-	3.0	2.0	4.2	5.0	-	4.3	4.3	5.0	3.3	3.7	4.6	2.7	3.0	-	-
Customer do not require us to resiter	1.5	1.0	1.0	1.2	1.5	2.3	1.0	1.6	1.6	2.0	1.3	1.4	1.2	2.0	3.0	1.0	1.0
Applied but found not effective	6.3	-	6.0	7.0	5.8	8.0	-	6.0	5.0	7.0	7.0	6.5	6.5	6.0	5.5	-	-
Registration is costly	3.1	-	5.0	5.0	2.9	3.9	3.0	2.7	2.3	2.2	2.0	2.0	2.7	2.8	4.0	-	-
Requirements too complicated	2.8	-	7.0	2.5	3.2	3.0	2.0	3.3	2.8	2.1	3.0	2.2	2.5	2.5	3.7	-	-
Application procedures too complicated	3.8	-	8.0	3.0	3.5	3.0	3.0	4.4	3.7	3.9	4.0	3.7	3.9	3.0	4.7	-	-
Products does not conform to standard	4.8	1.0	2.0	5.0	3.8	5.4	-	5.3	7.0	4.3	4.7	3.0	5.1	5.7	4.3	-	-
Applied once buy could not maintain requirements	6.7	-	4.0	6.0	7.2	7.2	-	7.4	8.0	6.3	6.3	5.5	7.2	6.0	5.5	-	-

4.6 REQUEST FOR SUPPLIERS OF RAW MATERIALS TO BE REGISTERED UNDER ARQS

Manufacturing firms that were themselves registered with the ARQS generally did not request the suppliers of raw materials, intermediates, and component parts to be registered under the ARQS (Table 22). As may be seen only 16% of these firms required their suppliers to be registered while 84% did not.

Among the firms that did not require registration with ARQS, this feeling was seen across the various industries, especially Fiber and Yarn, Woven and Knitted fabrics, Cement and Concrete products, Wood products and Steel bars.

TABLE 22 : REQUEST SUPPLIERS OF RAW MATERIALS/
INTERMEDIATES TO BE REGISTERED UNDER ARQS

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	249	5	3	14	65	30	8	26	26	20	16	15	40	15	10	4	1
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Yes	16	-	-	7	15	27	13	27	31	20	25	27	10	-	30	-	-
No	84	100	100	93	85	73	77	73	69	80	75	73	90	100	70	100	100

5. QUALITY CONTROL

5.1 ACTIVITIES ADOPTED/PLANNED TO BE ADOPTED

Most of the manufacturing firms had already initiated some form of quality control, as can be seen from Table 23. Among the more common activities already adopted were visual product inspection (83%), inspection in process (77%) and product inspection by testing equipment (62%).

Where quality control activities were not yet instituted, significant numbers of firms indicated that they were planning to implement them. Such activities are ARQS (43%), QC circles (35%), engagement of quality consultants (28%) and employee suggestion system (28%).

Firms were also quite ignorant of some of the quality control activities such as quality improvement practice (41%), ARQS (25%), seven tools for QC (36%) and Five S (36%).

TABLE 23 : ACTIVITIES FOR QUALITY CONTROL

	Adopted	Planned	Don't know
Base	303 %	303 %	303 %
Product inspection			
– visual	83	1	2
– by testing equipment	62	10	10
Inspection in process	77	4	5
Statistical Quality Control			
– for process	36	26	12
– for product	40	26	11
Establishment of QC Department	59	17	8
Documentation of quality practice	54	22	6
ARQS	10	43	25
Quality improvement practice	8	24	41
Engagement of quality consultant	15	28	27
Development of in-company standards	45	23	11
QC circles	22	35	16
Employee suggestion system	33	28	14
Seven tools for QC	18	18	36
Five S	19	17	36
Training on QC			
– in house training	63	15	8
– outside training	28	33	17

5.2 PROBLEMS ENCOUNTERED IN IMPLEMENTING QUALITY CONTROL

Among the various problems faced by manufacturing firms, the more common ones, as shows in Table 24, were:-

Lack of adequate staff to introduce QC	(48%)
Lack of knowledge of QC methods	(40%)
Job hopping	(40%)
Apathy of employees	(36%)

It is therefore clear that lack of expertise, lack of knowledge and job hopping by employees were the three most important reasons. These reasons were seen across the various industrial sectors especially in the Automotive parts manufacturing sector where at least six out of ten firms mentioned these problems.

TABLE 24 : PROBLEMS ENCOUNTERED IN IMPLEMENTING QUALITY CONTROL

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	12	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Ignorance by management	10	-	-	-	14	12	10	7	7	16	11	5	12	6	33	-	-
Apathy of employees	36	22	13	15	47	44	60	41	14	32	28	30	23	31	33	43	-
Lack of knowledge of QC methods	40	33	13	35	41	38	20	72	46	40	44	45	48	-	25	57	-
Lack of adequate staff to introduce QC	48	44	38	55	46	53	40	76	36	48	50	40	44	44	25	43	-
Lack of time to carry out QC activities	26	11	13	15	31	38	10	31	32	28	6	20	27	19	25	14	-
Unconcern of customers	7	-	-	-	4	6	-	7	7	16	6	30	15	6	8	14	-
Cost increases	27	11	-	30	32	35	-	28	21	36	33	40	38	19	33	14	50
Job hopping	40	33	38	60	40	53	50	72	25	40	50	35	38	19	17	14	-
Lack of commitment	1	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-
None	21	44	38	15	16	18	30	3	32	28	22	20	25	38	17	14	50

6. TESTING FACILITIES

6.1 INCIDENCE OF USEAGE OF OUTSIDE FACILITIES FOR TESTING/ CALIBRATION

Slightly more than half (52%) of firms surveyed indicated that they had used outside laboratories for testing and calibration (Table 25). Industries that had a significant number indicating this were Cement and Concrete products (81%), Automotive assembly (80%), Automobile parts manufacturing (79%). For these industries approximately eight out of ten industries indicated this.

Other industries that were quite significant were Rubber related products and processing (74%), Electrical and Electronics (71%) and Bricks, Ceramic and Gypsum products (67%).

6.2 USAGE OF OUTSIDE LABORATORIES FOR TESTING

The majority of firms indicating that they used outside laboratories for testing, did so for Calibration purposes with 58% indicated this (Table 26). Chemical testing (46%) and Physical testing (34%) were also common purposes.

Industries that tended to use outside laboratories significantly for Calibration purposes were Electrical and Electronics (75%), Cement and Concrete products (92%), Automotive assembly (75%) and Brick, Ceramic and Gypsum products (75%).

These same industries generally also tended to use these facilities for Chemical and Physical testing procedures.

6.3 FREQUENCY OF USING OUTSIDE LABORATORIES

Of those firms that used outside laboratories for the various areas of testing, most used them once a year (Table 27). Of those using these facilities once a year, 34% were for Calibration, 14% for Mechanical testing, 47% for Electrical testing, 15% for Chemical testing and 11% for Physical testing.

For Physical testing, however, larger establishments possibly used outside laboratories more frequently. Another 13% used them twice yearly, while 15% used them as much as eleven to fifteen times a year, indicative of a standard testing procedure.

6.4 INSTANCE WHERE OUTSIDE LABORATORIES USED

Apart from a significant number of firms that were not sure of the number of times they had used outside laboratories the majority of the others were not frequent users, mostly using only once (Table 28).

Among these infrequent users, the common test area was in the area of Calibration (42%), followed next by Chemical testing (30%) and Physical testing (28%).

6.5 AREAS IN WHICH NEW OUTSIDE LABORATORIES EXPECTED

Although approximately 27% of the firms were quite satisfied that no additional outside laboratories were needed, 19% indicated that new laboratories were needed for Calibration purposes, 16% for Chemical and 12% for Mechanical (Table 29). This general feeling was felt among the various industries.

Among those that felt that no additional outside laboratories were needed, Woven and Knitted fabric (75%) and garments (60%) were quite strong in this.

TABLE 25 : INCIDENCE OF USAGE OF OUTSIDE LABORATORIES

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	12	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Yes	52	44	38	10	38	74	80	79	71	64	50	40	37	81	67	57	50
No	48	56	63	90	62	26	20	21	29	36	50	60	63	19	33	43	50

TABLE 26 : USAGE OF OUTSIDE LABORATORIES FOR TESTING

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	158	4	3	2	31	25	8	23	20	16	9	8	19	13	8	4	1
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Calibration	58	25	-	-	48	68	75	57	75	44	33	50	42	92	75	25	-
Mechanical	27	-	-	-	29	16	63	35	20	69	33	50	32	15	-	25	100
Electrical	12	-	-	-	6	4	13	17	55	13	-	-	-	8	-	-	-
Chemical	46	100	100	50	52	60	75	52	15	56	11	38	26	46	63	-	100
Physical	34	75	67	100	32	72	25	48	15	19	-	13	16	31	25	25	-
Others	6	-	-	-	3	12	-	9	-	-	22	38	16	8	13	-	-
Don't know	9	-	-	-	16	8	-	4	10	13	22	-	21	-	-	50	-

TABLE 27: FREQUENCY OF USAGE OF OUTSIDE LABORATORIES

Frequency Of Usage	AREA OF TEST					
	Cali-bration	Mecha-nical	Elec-trical	Chemical	Physical	Others
Base:	90	44	19	72	53	9
	%	%	%	%	%	%
Once a year	34	14	47	15	11	33
Twice a year	11	11	5	11	13	11
Three times a year	3	2	–	11	6	–
Four times a year	3	2	5	6	6	22
Five to ten times a year	4	5	5	7	4	–
Eleven to Fifteen times a year	6	5	5	11	15	22
More than 15 times a year	–	–	–	6	–	–
As and when required	3	11	–	8	8	22
Don't know	38	52	32	33	40	11

TABLE 28: CASES WHERE OUTSIDE LABORATORIES USED

Area of Test	One Case	Two Cases	Three Cases	Not Sure
Base:	158	158	158	158
	%	%	%	%
Calibration	42	8	6	43
Mechanical	20	4	4	72
Electrical	7	3	2	88
Chemical	30	8	8	54
Physical	28	3	3	66
Others	4	2	–	94

TABLE 29 : AREAS IN WHICH NEW OUTSIDE LABORATORIES EXPECTED

	Total	Fiber	Woven	Gar-ments	Plas-tic	Rubber	Auto Assem.	Auto Parts	Elec.	Foun-dry	Mould die	Steel Fabr.	Wel-ing	Cem-ent	Brick	Wood	Steel bar
Base:	303	9	8	20	81	34	10	29	28	25	18	20	52	16	12	7	2
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Calibration	19	11	-	5	19	26	30	24	32	16	28	10	15	19	17	14	-
Mechanical	12	11	-	5	11	6	30	17	4	16	22	15	23	13	17	29	-
Electrical	6	-	-	-	5	6	10	-	29	-	-	-	2	13	8	-	-
Chemical	16	11	-	5	20	29	30	17	7	12	11	5	8	-	25	-	-
Physical	9	11	-	10	7	18	-	10	4	4	-	5	2	6	25	14	-
Others	2	-	-	-	1	-	-	7	7	-	6	5	4	6	-	-	-
Expect No Additional Laboratory	27	44	75	60	27	35	20	31	25	20	11	25	23	13	8	29	-
No comments	36	22	25	20	31	24	30	21	32	52	44	50	40	56	50	43	100

7. MANPOWER

7.1 QUALIFICATIONS OF STAFF

A general indication of the professional staff employed in the surveyed firms in given in Table 30. This represents a tally count of the questionnaires returned from the 303 manufacturers.

As would have been the trend, first degree holders (eg. Bachelor's degree) and diploma holder's) constituted the bulk of these professional staff. Of the 2105 professional staff, first degree holders made up 947 (or 44%) and diploma holders 951 (45%), therefore together accounting for almost 90% of the total.

Analysing by the different disciplines eg. science and engineering, for the former first degree holders outnumbered the latter. For engineering disciplines, however, diploma holders outnumbered first degree holders.

Within the science discipline, there were more chemistry graduates employed. Of the total of 506 in this group 230 (or 45%) were in this category. Within the engineering discipline, however, mechanical engineering graduates were the mode, comprising 537 of the 1599 (or 34%) under this category.

TABLE 30 : QUALIFICATION OF STAFF (NUMBERS)

	<----------TYPE OF DEGREE---------->				
Discipline	Phd.	Masters	First Degree	Diploma	Total
Science					
- Maths	5	5	42	20	72
- Physics	5	4	28	9	46
- Chemistry	10	9	164	47	230
- Life Sciences	4	7	46	15	72
- Materials	5	6	34	41	86
Sub-total	29	31	314	132	506
Engineering					
- Electrical	5	17	121	167	310
- Electronics	4	7	56	80	147
- Software	4	10	44	50	108
- Production	4	8	59	116	187
- Mechinical	8	14	251	264	537
- Design	5	5	24	55	89
- Civil	5	22	57	27	111
- Quality Assurance	5	24	21	60	110
Sub-total	40	107	633	819	1599
Total	**69**	**138**	**947**	**951**	**2105**

7.2 EMPLOYMENT OF STAFF IN VARIOUS FUNCTIONS

Of the degree and diploma holders involved in various specified functions (Table 31), the former outnumbered the latter (598 to 495).

Collectively, most of them were involved in New Product Development (23%), Product redesign/adaptation (20%) and Testing and analysis (19%). Another 13% were engaged in Machinery redesign/adaptation and 11% in Fundamental and applied research.

Individually, degree holders and diploma holders were observed to be engaged in the three main functions, similar to the general overall trend.

7.3 LIKELIHOOD OF COMMISSIONING FUTURE R&D ASSISTANCE

Among the various functions, most of the 303 firms surveyed appeared to be unlikely to commission future R&D assistance in the next one to two years, as seen from Table 32. Except for New product development, product redesign/adaptation and Testing and analysis where firms indicated a `possibility', the rest were quite unlikely to do seek R&D assistance in the coming two years.

However, in the next three to five years, firms were a bit positive in saying that they may possibly seek R&D assistance, perhaps indicative of their relative state of preparedness now. They may not be ready in the next one or two years but possibly in the next three to five years.

TABLE 31 : STAFF INVOLVED IN VARIOUS FUNCTIONS

	NUMBER OF STAFF					
Function	Degree *Holders*	%	Diploma *Holders*	%	*Total*	%
Fundamental and applied research	62	10	57	11	119	11
New product development	146	24	109	22	255	23
Product redesign/ adaptation	129	22	88	18	217	20
New machinery design	39	7	39	8	78	7
Machinery redesign/ adaptation	85	14	63	13	148	13
Software development	30	5	43	9	73	7
Testing and analysis	107	18	96	19	203	19
Total	598	100	495	100	1093	100

TOTAL 32: LIKELIHOOD ON COMMISSIONING FUTURE R&D ASSISTANCE

	-----IN NEXT 1-2 YEARS-----			----IN NEXT 3-5 YEARS-----		
Functions	Unlikely	Possibly	Likely	Unlikely	Possibly	Likely
Base:	303	303	303	303	303	303
	%	%	%	%	%	%
Fundamental and applied research	28	17	9	17	21	9
New product development	22	24	15	11	24	12
Product redesign/ adaptation	21	25	13	11	22	13
New machinery design	24	16	9	14	19	9
Machinery redesign /adaptation	20	19	12	12	18	11
Software development	22	17	9	15	17	10
Testing and analysis	19	20	16	12	18	13

8. GOVERNMENT ASSISTANCE

8.1 SUGGESTION FOR GOVERNEMENT ASSISTANCE

Numerous suggestions were given by the 303 manufacturing establishments with regard to government assistance on promotion of industrial standardisation and quality control. The most prominent was 'More trainig and consultancy' as indicated by 11% of these firms, indicative of the general lack of information and know-how among most firms. The various suggestion put forward are shown in Table 32 below.

TABLE 33: SUGGESTIONS FOR GOVERNMENT ASSISTANCE

Suggestions	No. of Firms	%
Reduce tax for imported machinery	5	2
Malaysian Standards to be accepted internationally	12	4
More seminars/forums	9	3
More dissemination of information	20	7
More training and consultancy	34	11
Simplify procedure for application	6	2
Reasonable testing fees	8	3
Improved facilities at SIRIM	6	2
Greater assistance and promotion	12	4
Provide greater incentives	4	1
Set up R&D centre	4	1
Greater attention to small-scale industries	2	1
Others	12	4

付編 7　マレイシアの工業計量体制および校正能力充実に関する参考資料

1　はじめに

マレイシアの工業計量体制および校正能力の現状と強化のための基本的な考え方については、本文4.2に提言した。以下は、この提言に基づく計量校正設備充実計画の参考案である。計量に関する計画、設計には高い専門性が必要であり、本調査の範囲を越えている。本参考案はおおよその方向を示すもので、実施段階に至る前に、マレイシア全体の計量、計量校正、法定計量等の体制についての総合的検討に基づいて別途計画策定を行うことが必要である。

2　計量研究所設備充実

2.1　必要設備機器

本文4.2.2に述べたように、SIRIMの計量研究所は一次標準を独立して実現・維持する研究所ではなくアジア地域における拠点の一つとして位置づける考え方が必要と思われる。

この考え方に基づいて、各量の標準の維持、管理は国際的な計量研究所に委ね、その計量研究所が保有する標準とトレーサブルである標準およびトレーサビリティをSIRIM計量研究所が維持・管理する考え方である。

この場合、マレイシアの計量研究所として必要となると考えられる主要計量設備、機器は次のとおりである。

(1)　長さ

光波干渉計、標準ブロックゲージセット、電子測微器、校正用標準ブロックゲージ各種、マイクロメーター各種、ハイトマスター、プロファイル・プロジェクター、三次元測定器、その他

(2)　質量

標準分銅セット（E2級およびそれ以下の級のもの）数種、天秤各種、比較器各種、天秤台各種

(3)　力・圧力

標準環状力計各種、ロードセル各種、精密級電圧計、標準マノメーター、硬度標準各種、圧力校正器各種、標準圧力計、その他

(4)　温度

定点校正装置、標準白金測温抵抗体、校正用炉、その他

(5)　体積・流量

電子台はかり、標準タンク各種、標準容器各種、その他

(6)　電気量

標準電池、電圧標準、標準抵抗各種、差動電圧計、電力増幅器、マルチメーター、標準容量、その他

(7)　測光

標準電球各種、積分球、スペクトロフォトメーター、標準光源各種、その他

(8) 音響

無響室、標準マイク各種、標準騒音計、その他

(9) 振動

起振機、信号発生機、標準ピックアップ、標準振動計、その他

(10) 標準物質

標準物質各種、各種分析計、その他

これらの計量設備・機器の中には現在SIRIMが保有するものも一部含まれているが、経年変化等を考え、上記に含めた。

これらの計量設備・機器の機材費は、約8億円[1] である。また、これらの設備・機器を設置するためのスペースおよび試験実施のためのスペースは、現在のSIRIMの計量ユニットとは別に、約3,500m^{2}程度必要である。

マレイシアにおいて計量研究所を設計する際に、注意しなければならない事項は次のとおりである。

1) 全館冷房が行われ、かつ、研究室毎に個別に温・湿度コントロールが可能であること。特に、長さ、時間、温度等の標準室は国際的な温度基準である20度プラス・マイナス0.5度Cに調整でき、かつ、維持できること。
2) 全館の湿度調整が行われること。マレイシアは高温多湿の気候であり、急に冷房すると測定器表面で結露する。水が付着すると測定器の精度や寿命に悪影響を与えるので、研究室ごとに除湿が可能なようにすること。
3) 振動を発生する設備・機器と振動を嫌う機器の配置、塵を発生する設備・機器と塵を嫌う機器の配置、水を使う設備・機器の配置等、設備・機器の配置および組み合わせに十分留意すること。
4) 直射日光が研究室内に入らないようにすること。
5) 使用する水はフィルターを通して、十分ろ過すること。
6) 電源の波形は可能な限り高調波を含まないものであること。必要に応じて、安定化電源を使用すること。また、研究所の電源は十分な容量を有すること。
7) 万一の停電に備え、データを破壊しないようにバックアップ電源を用意し、瞬時に切り換えられるようにすること。
8) 室内の照明は明るすぎないこと。

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1) ただし、価格は日本におけるカタログ価格（特注のものは想定価格）であり、輸送費用、設置費用、操作費用、操作指導のための技術者派遣用等の付帯費用は含まない。

この他、設計段階において十分な討議と、必要があれば専門家の助言を得ることが望ましい。これに要する建設費は約5億円[2] 程度と見込まれる。

2.2 設備拡充プログラム

(1) 実施機関: SIRIM

(2) 期間: このプログラムは、現在SIRIM本部の計量ユニットを組織的に標準部から独立した計量研究所とし、その計量設備を拡充させる計画である。新たに計量研究所としての建屋を増設し、設備・機器を設置することから、準備から実施まで3年を要するものと思われる。

(3) 行動プログラム

1) 調査・準備段階

a) 量別の精度目標の設定

すでにSIRIMは量別に精度の達成目標を計画しているが、本計画を策定する際には、計量の国際ネットワークとの関係において達成目標を明確にする必要がある。

b) 設備・機器の選択

a)において精度目標が設定されたならば、その精度を達成するに必要な設備・機器を選択する。

c) 研究所の設計

b)項で選択した計量設備・機器および現在の計量ユニットから移動する一部の設備・機器の設置に必要なスペース、計量校正実施に必要な作業台等の設備に必要なスペースおよび校正を実施するために必要となるスペースを算出する。更に計量研究所として間接的に必要となるスペース（技術者室、倉庫、廊下、トイレ等）を算出し、これらをもとにして計量研究所の建屋の設計を行う。設計にあたっては、2.1に述べた注意事項を十分に勘案することが必要である。

研究室や計量設備・機器のレイアウトを決め、電気配線や水道管等の配置を決める。

d) 見積

計量設備・機器の購入費用および建屋の建設費用の見積を行い、必要となる予算を準備する。

e) 研究所の建設

設計に従って、建屋の建設ならびに機器の購入、搬入および設置を行う。

f) 研修計画の策定

計量技術者の教育・訓練計画を、量毎に作成する。

g) 新規職員の採用

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2) マレイシアの建築業者によって建設するものと想定。

雇用計画を策定し、それに応じて定期的に雇用する。

2) 実施段階

a) 国際的なトレーサビリティの確保

SIRIMが保有する国家標準を、国際的な計量研究所において値づけをしてもらい、その標準をもとにSIRIM計量研究所内の標準の値づけを行う。

b) 標準の維持・管理

保有する標準の維持・管理のため、研究を開始する。

c) 校正サービスの実施

他の機関、企業等からの依頼を受け、計量校正サービスを実施する。また、SIRIM内部の部署で使用している設備・機器の校正も、SIRIM内部で確立した校正プロセデュアに基づいて実施する。

d) 研修の実施

研修計画に基づいて、職員に対する教育・訓練を実施する。

e) 国際比較への参加

APMP等が実施する量別の国際比較に参加し、レベルの向上を目指す。

3) 拡張段階

a) 精度達成目標の見直し

工業の発展や技術の進歩に応じて、精度達成目標を修正する必要が生じた場合、これを見直す。

b) 計量設備・機器の整備

精度達成目標の見直しによって必要となる計量設備・機器を購入、設置する。

c) 職員の研修

引き続き、校正技術や標準の維持・管理技術向上のために技術者の研修を行うことが必要である。

4) 専門家の指導・助言

計量研究所の設計段階において、経験のある専門家の技術指導および助言が必要と思われる。また、計量研究所設立後は、標準の維持・管理技術および校正技術の習得および向上のため専門家の受け入れおよび研修生の派遣が有力である。

短、中、長期別プログラムを表A7-1に示す。

3　地方における計量校正実施能力の拡大

3.1　必要設備機器

本文4.2.2に述べた各支所の計量校正を主体とした研究所における必要な計量設備・機器は次のとおりである。

(1)　長さ

標準ブロックゲージセット、電子測微器、校正用標準ブロックゲージ各種、マイクロメーター各種、ハイトマスター、プロファイル・プロジェクター、その他

(2)　質量

標準分銅セット（F1級およびそれ以下の級のもの）数種、天秤各種、比較器各種、天秤台各種

(3)　力・圧力

標準環状力計各種、ロードセル各種、精密級電圧計、硬度標準各種、圧力校正器各種、標準圧力計、その他

(4)　温度

標準白金測温抵抗体、標準熱電体、恒温浴槽、その他

(5)　体積・流量

電子台はかり、標準容器各種、その他

(6)　電気量

標準電池、電圧標準、標準抵抗各種、差動電圧計、電力増幅器、マルチメーター、標準容量、その他

なお、北部支所はすでに電気量の研究室を整備している。

これらの計量設備・機器の機材費は、一研究所あたり約3億円[3)]である。また、これらの設備・機器を設置するためのスペースおよび試験実施のためのスペースは、約1,500m^{2}程度が必要である。設計に際しての注意事項は計量研究所の場合と同じであるが、更に地域的な事情があれば、

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3)　価格は日本におけるカタログ価格（特注のものについては想定価格）であり、輸送費用、設置費用、操作指導のための技術者派遣費用等の付帯費用は含まない。

それも考慮にいれることが必要である。一研究所あたり約1億5,000万円[4] 程度の建設費が必要であると推定される。

3.2 実施能力向上プログラム

(1) 実施機関: SIRIM

(2) 期間: このプログラムは、SIRIMの支所において計量校正サービスを実施する計画である。新たに研究所としての建屋を建設し、設備・機器を設置することから、準備から実施まで3年を要するものと思われる。

(3) 行動プログラム

1) 調査・準備段階

a) 計量校正ニーズの把握と校正範囲の決定

ペナン、ジョホールバルおよびサラワクの各地域において、それぞれの工業の特色を考慮しつつ、計量校正サービスのニーズを把握し、これに基づき校正範囲を決定する。

b) 設備・機器の選択

a)において計量校正サービスのニーズを分野として把握し、その他の基本量も含めて、計量設備・機器を選択する。

c) 研究所の設計

b)項で選択した計量設備・機器の設置に必要なスペース、計量校正実施に必要な作業台等の設備に必要なスペースおよび校正を実施するために必要となるスペースを算出する。更に計量研究所として間接的に必要となるスペース（技術者室、倉庫、廊下、トイレ等）を算出し、これらをもとにして計量研究所の建屋の設計を行う。設計にあたっては、2.1で述べた注意事項を十分に勘案することが必要である。

研究室や計量設備・機器のレイアウトを決め、電気配線や水道管等の配置を決める。

d) 見積

計量設備・機器の購入費用および建屋の建設費用の見積を行い、必要となる予算を準備する。

e) 研究所の建設

設計に従って、建屋の建設ならびに機器の購入、搬入および設置を行う。

f) 研修計画の策定

計量技術者の教育・訓練計画を、量毎に作成する。

2) 実施段階

a) トレーサビリティの確保

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4) マレイシアの建設業者によって建設するものと想定

SIRIMが保有する国家標準によって、当該地方研究所の標準に値づけをしてもらう。

b) 校正サービスの実施

他の機関、企業等からの依頼を受け、計量校正サービスを実施する。

c) 研修の実施

研修計画に基づいて、職員に対する教育・訓練を実施する。

3) 拡張段階

a) 校正範囲の見直し

工業の発展や技術の進歩に応じて、校正範囲を修正する必要が生じた場合、これを見直す。

b) 計量設備・機器の整備

校正範囲の見直しによって必要となる計量設備・機器を購入、設置する。

c) 職員の研修

引き続き、校正技術向上のために技術者の研修を行うことが必要である。

4) 専門家の指導・助言

校正技術の習得および向上のため専門家の受け入れおよび研修生の派遣が有力である。

短、中、長期別プログラムを表A7-2に示す。

表 A7-1　計量研究所設備充実プログラム

	短　　期	中　　期	長　　期
実施機関	ＳＩＲＩＭ	ＳＩＲＩＭ	ＳＩＲＩＭ
施　　策	①精度達成目標の設定 ②設備・機器リスト作成 ③計量研究所の設計 ④予算措置（機材購入費、建屋建設費） ⑤研究所の建設 ⑥研修計画の策定 ⑦職員の雇用 ⑧業界へのＰＲ	①標準の値付け ②標準の維持・管理 ③計量校正サービスの実施 ④国際比較の実施 ⑤技術者の研修	①制度達成目標の見直し ②計量設備・機器の購入、設置 ③技術者の研修
支援機関と支援内容	特になし	特になし	特になし
実行場所	ＳＩＲＩＭ	ＳＩＲＩＭ	ＳＩＲＩＭ
実施要領	①精度達成目標を設定する ②研究所建設に係る設計および施工 ③計量設備・機器のリスト・アップ、購入および設置 ④職員の雇用 ⑤研修計画の立案 ⑥ＳＩＲＩＭがセミナー等によりＰＲする	①標準の維持・管理、その技術開発 ②校正サービスの実施 ③技術者の教育・訓練の実施 ④マレイシアを代表して国際比較に参加する	①精度達成目標を見直し、修正する ②必要となる計量設備・機器のリスト・アップ、購入、設置 ③技術者の教育・訓練の実施
外国からの技術援助	①研究所設計の技術的情報	①標準の維持・管理技術 ②校正技術	

表 A7-2　地方における計量校正実施能力の拡大プログラム

	短　　期	中　　期	長　　期
実施機関	ＳＩＲＩＭ	ＳＩＲＩＭ	ＳＩＲＩＭ
施　　策	①校正範囲の決定 ②設備・機器リスト作成 ③計量研究所の設計 ④予算措置（機材購入費、建屋建設費） ⑤研究所の建設 ⑥研修計画の策定 ⑦業界へのＰＲ	①標準の値付け ②計量校正サービスの実施 ③技術者の研修	①校正範囲の見直し ②計量設備・機器の購入、設置 ③技術者の研修
支援機関と支援内容	特になし	特になし	特になし
実行場所	ＳＩＲＩＭ各支所	ＳＩＲＩＭ各支所	ＳＩＲＩＭ各支所
実施要領	①ニーズを把握し、校正範囲を決定する ②研究所建設に係る設計および施工 ③計量設備・機器のリスト・アップ、購入および設置 ④研修計画の立案 ⑤ＳＩＲＩＭがセミナー等によりＰＲする	①標準の値付けをしてもらう ②校正サービスの実施 ③技術者の教育・訓練の実施	①校正範囲を見直し、修正する ②必要となる計量設備・機器のリスト・アップ、購入、設置 ③技術者の教育・訓練の実施
外国からの技術援助		①校正技術